



DARK ENERGY
SURVEY

The DES Calibrations Effort

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- The DES Calibrations Effort has connections within and between the four formal DES Projects (DECam, DESDM, CFIP, and Science Committee).
- Due to the need to facilitate DES-wide communications in this area, the DES Calibrations Effort is located within the DES Project Office in the DES Organization Chart.
- Calibration activities that fall fully within one of the four formal projects (e.g., the construction of the 10-micron all-sky cloud camera within the DECam Project) are funded through that project.
- Calibration activities that do not fall within one of the four formal projects, must be funded come from other sources (e.g., from individual institutions or from the DES common fund).
- This talk covers some of the calibration activities that fall in the interstices between the four formal projects.



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CTIO-1m Observing Runs

1. **Purpose:** To perform on-sky engineering and calibration tests with a DECam 2k x 2k CCD on the SMARTS-1m telescope at CTIO.
2. **Benefits to DES:** These runs will provide initial measurement of transformation relations between SDSS *griz* (*g'r'i'z'*) and DES *griz* and initial calibration of DES Y-band standards, as well as permitting a variety of short- and longer-term calibration tests.
3. **Costs:** Driven primarily by travel to observing runs, plus cost of a set of 4-in DES *grizY* filters:
 - a) One 7-night observing run per semester for 4+ semesters
 - b) One observer from the DES Calibrations Effort per observing run
 - c) \$3K/run/observer
 - d) ~\$10K for a set of 4-in DES *grizY* filters
 - e) Total est. direct costs: \$12K over 2 years (travel) + \$10K (filters) = \$22K
4. **Status:** Previous runs in April 2008, October 2008, June 2009 (primarily engineering); upcoming run in September 2009.



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White Dwarf Calibrations Effort

1. **Purpose:** To establish a “golden sample” of pure hydrogen atmosphere (“DA”) white dwarf spectrophotometric standards within the DES footprint.
2. **Benefits to DES:** The golden sample will provide absolute flux and color calibration for the DES photometry
3. **Costs:** Driven in large part by travel to observing runs to follow up candidate white dwarfs for the golden sample :
 - a) One 3-4 night observing run per semester for 4+ semesters
 - b) Two observers per observing run
 - c) \$2.5K/run/observer
 - d) Total est. direct costs for travel: \$20K over 2 years
4. **Status:** Initial list of white dwarf candidates has been identified. Some follow-up observations have begun in mid-2009. A related project (*u*-band Observations of the Blanco Cosmology Survey; PI: J. Allyn Smith) has received observing time in 2009B but is awaiting word from NSF on funding.



Joint LSST-DES Observing Runs

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1. **Purpose:** To characterize atmospheric extinction (including clouds) in order to develop techniques to improve photometry from large imaging surveys (led by the LSST Calibrations Group).
2. **Benefits to DES:** The results from these run will potentially improve the efficiency of DES operations by reclaiming observing conditions not traditionally considered photometric.
3. **Costs:** Driven primarily by travel to observing runs :
 - a) One 3-4 night observing run per semester for 4+ semesters
 - b) Typically two DES observers (and two LSST observers) per observing run
 - c) \$2.5K/run/observer
 - d) Total est. direct costs: \$20K over 2 years (DES observers)
4. **Status:** Just beginning. First joint run was July 3-5, 2009 (last week).



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PreCam Survey

1. **Purpose:** To perform a quick, bright survey of the DES footprint in the DES *grizY* filter system using a 2x2 mosaic of DECam 2k x 2k CCDs placed on the University of Michigan Curtis-Schmidt telescope at CTIO.
2. **Benefits to DES:** The primary goal of the PreCam Survey is to improve the photometric calibration of the DES by providing *grizY* in each DECam field of view (for nightly calibrations) and by effectively providing 1 or more additional calibration tilings of the DES footprint (for global relative calibrations).
3. **Costs:** Total estimated direct M&S costs (including travel) are <\$150K, of which \$66.5K is due to travel associated with the observing runs.
4. **Status:** Negotiations are in progress for use of the Curtis-Schmidt. A preliminary WBS has been prepared. A draft proposal requesting endorsement from the DES Management Committee has been written up.



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Extra Slides



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Some Background Material

1. DES Calibration Plan

- Overview: Tucker et al., astro-ph/0611137
- Prototype WBS for 2008-2017 (used as input for the DES Integrated Project Schedule):
<http://home.fnal.gov/~dtucker/DESCalibWBS/DESCalib-GanttProject-chart.html>

2. White Dwarf Calibrations Effort

- Proposal to DES Management Committee:
<http://des-docdb.fnal.gov:8080/cgi-bin/ShowDocument?docid=2505>

3. PreCam Survey

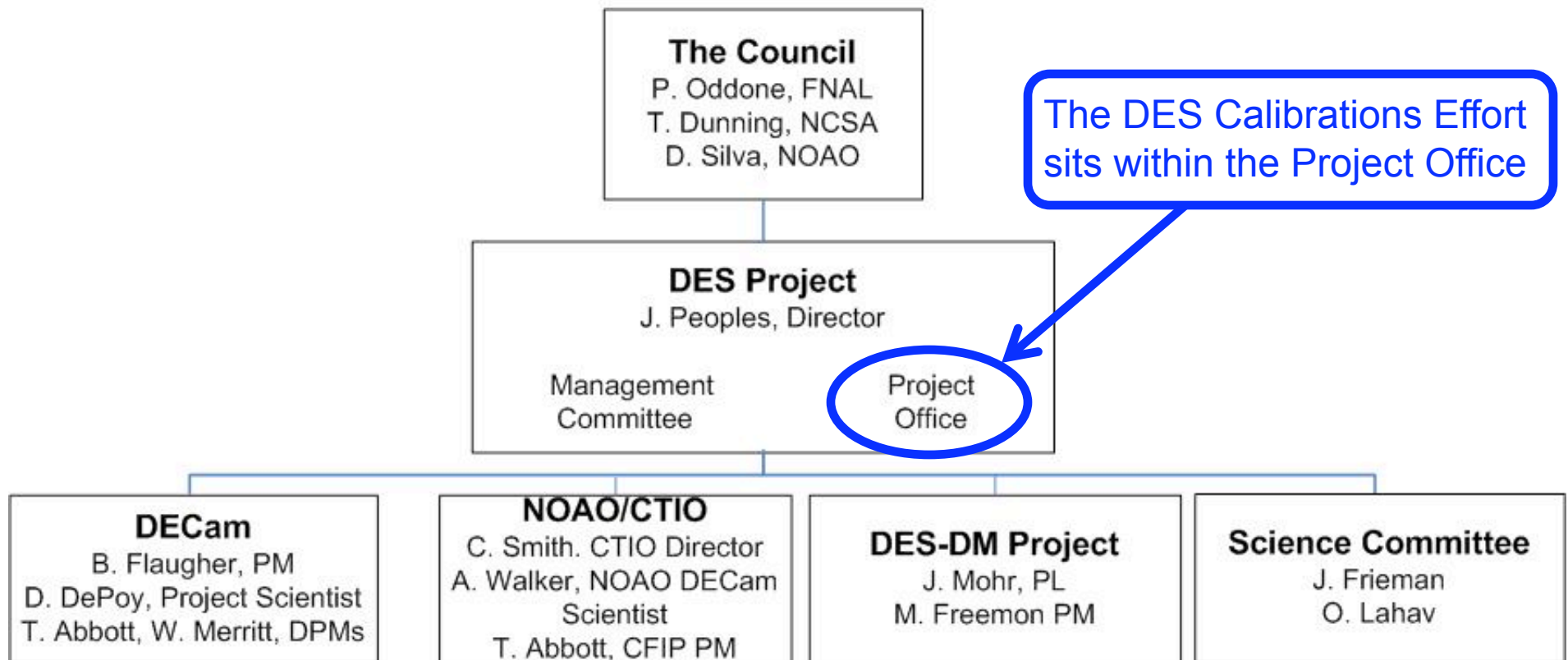
- Prototype WBS for 2008-2011:
<http://home.fnal.gov/~dtucker/DESCalibWBS/PreCamWBS/PreCam-GanttProject-chart.html>
- Estimated Direct Costs (including Travel):
<http://home.fnal.gov/~dtucker/DESCalibWBS/PreCamWBS/PreCam-BOE.xls>



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The Location of the DES Calibrations Effort within the DES Organization Chart

Dark Energy Survey Projects



The DES Calibrations Effort has connections both within and between the four formal DES Projects.



Baseline PreCam Survey Overview

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- For baseline instrument (2x2 mosaic of DECam 2k x 2k CCDs):
 - FOV of $1.6^\circ \times 1.6^\circ$ (2.56 sq deg) at a pixel scale of 1.4 arcsec/pixel
 - 1950 fields to cover 5000 sq deg; including 50% overlap \rightarrow 2925 fields
 - At 10 min per field (exposure times+readout+slew times), it would take 487.5 hours, or about 61 nights, to perform a “1.5-pass” PreCam Survey in all 5 DES filters
 - Add various overheads \rightarrow 90-100 scheduled nights

Baseline PreCam Survey Point-Source Magnitude Limits (optimized to achieve S/N=50 at DES saturation + 1.5mag)

Band	Exposure time [seconds]	PreCam saturation limit	PreCam mag limit S/N=50	Number of usable stars per sq deg (SGP)
g	36	12.8	17.8	186
r	51	13.2	17.8	265
i	65	13.4	17.7	344
z	162	14.1	17.5	317
Y	73	11.6	14.3	150